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SPORTS BALL AND PRODUCTION METHOD THEREOF

Background of The Invention

The present invention relates to a sports ball and its production method, and relates especially to a sports ball used for such sports as volleyball, basketball, dodgeball, soccer, or handball, and the production method for the ball.

Hitherto, sports balls are produced by two method. A former ball is produced, for example, by filling air into an inflatable tube and attaching cloth pieces closely on the surface of the tube with latex, or by winding yarns around the surface of the tube and fixing yarns on the surface with adhesive agent to form a reinforced layer followed by the adhesion of the outer layer. And a latter ball is produced with the following steps, for example, as disclosed in a Japanese patent application, First publication, 58-29112. Cloth pieces are attached on the surface of an empty globe which consists of brittle material such as paraffin, and form a cloth pouch. The globe is taken out from the pouch and an inflatable tube is put into the pouch in turns. The tube is filled with air and protrude bars are formed on the alignments which is formed on overlap portion of cloth pieces each other. And then, an outer layer is attached on the surface of the pouch along the bars.

The former ball has high strength, advantageously, because the tube is protected by a reinforced layer which is located exterior of the tube. The latter ball may keep its property, advantageously, because the space is located between an inner surface of the pouch and an outer surface of the tube, so this ball may absorbs strain which is caused by external forces.

However, the former ball is relatively hard and inferior in

softness. And the latter ball is superior in softness, though production efficiency is low and it costs much money because it needs complex production steps such as; forming an empty globe which consists of brittle material, attaching cloth pieces on the surface of the globe to form a cloth pouch, and taking out the globe from the pouch.

In view of above, it is an object of the present invention, to provide a sports ball having superior to properties such as strength, durability, softness, and elasticity, for use in sports such as
volleyball, basketball, dodgeball, soccer, or handball. And the present invention also provides the production method of such a sports ball, especially, which enables to produce the ball with simple steps and on a large scale.

Summary Of The Invention

In the present invention, these objects are realized by providing a sports ball which comprises; an inflatable tube; a covering layer which consists of a very thin rubber pouch and covering around the tube; a reinforced layer which is formed on the surface of the covering layer; and an outer layer which is formed on the surface of said reinforced layer; wherein, an inorganic lubricant is located between the tube and the covering layer, and the tube is spaced from the covering layer.

The covering layer is made of a material which does not permit a solution of an adhesive agent such as an aqueous solution of latex or a solution of an adhesive agent which contains rubber to diffuse through the covering layer. And the reinforced layer may be formed by attachment of cloth pieces on the surface of the covering layer and fixing cloth pieces on the surface with the solution of adhesive agent, or by winding yarns around the surface of the covering layer and fixing yarns on the surface with the solution of adhesive agent.

Furthermore, in the present invention, an object of a production method is also realized by comprising the steps of: injecting a powder of the inorganic lubricant between the inflatable tube and the covering layer or spreading a powder or a suspension of the inorganic lubricant on the inflatable tube and inserting the tube into the covering layer; forming the reinforced layer on a surface of the covering layer; forming an alignment on a surface of the reinforced layer by molding; and attaching the outer layer on the surface of the reinforced layer along the alignment.

In the present invention, the inflatable tube is protected by the covering layer, the reinforced layer, and the outer layer, which are located exterior to the tube.

And an adhesion between the tube and the covering layer is prevented, so that the tube is covered with the covering layer which consists of a very thin rubber pouch which is made of the material which does not permit the solution of an adhesive agent such as an aqueous solution of latex or a solution of an adhesive agent which contains rubber to diffuse through the pouch. Therefore, the tube is spaced to the covering layer.

Further, because of a spacing between the tube and the covering layer, thin air layer is formed between the tube and the covering layer. An elasticity of this air layer in addition to that of air filled in the tube, allows high softness, and desirable elasticity of the ball.

Thus, because of the spacing between the tube and the covering layer, shock from outside is absorbed and relieved by synergism of the air layer which is formed between the tube and the covering layer, and the air which is filled in the tube. Therefore, the reaction which was forced on human body from the ball is reduced about one third, and touch of the ball comes to more softly, so property of the ball is improved.

Furthermore, because of the existence of the inorganic lubricant between the tube and the covering layer, a sliding motion is caused between the tube and the covering layer when the ball receives a shock from outside. Therefore, the shock is reduced by this sliding motion, and durability of the ball is improved.

And the adhesion between the tube and the covering layer is prevented when air is filled in the tube, so that the powder of the inorganic lubricant is injected into the covering layer which consists of the very thin rubber pouch which is made of the material which does not permit the solution of an adhesive agent such as an aqueous solution of latex or a solution of an adhesive agent which contains rubber to diffuse through the pouch. This adhesion between the tube and the covering layer is also prevented by the spreading of the powder or the suspension of the inorganic lubricant, followed by inserting the tube into the covering layer. Therefore, both the tube and the covering layer may inflate uniformly without any sticking.

Further, the covering layer consists of the very thin rubber pouch which is made of the material which does not permit the solution of an adhesive agent such as an aqueous solution of latex or a solution of an adhesive agent which contains rubber to diffuse through the pouch. So the solution of the adhesive agent does not enter into the space between the tube and the covering layer when the reinforced layer is formed on the covering layer, by attaching cloth pieces or by winding yarns. Therefore, the adhesion between the tube and the covering layer is prevented.

Furthermore, the inorganic lubricant exists between the tube and the covering layer, the adhesion between the tube and the covering layer is prevented when the alignment is formed on the surface of the reinforced layer by molding. Therefore, the tube is spaced to the covering layer and it enables to obtain the ball having the tube may slide against the covering layer.

Brief Description Of The Drawings

FIG. 1 is a partial crosssectional view of the ball in connection with the first embodiment of the present invention.

FIG. 2 is an operation chart to produce the ball in connection with the first embodiment of the present invention.

FIG. 3 is an oblique view of the very thin rubber pouch which consists of the covering layer of the second embodiment of the present invention.

Description Of The Preferred Embodiment

In the following description, A first embodiment of the present invention will be illustrated with references to the drawings. In FIGS. 1 and 2, an inflatable tube 1 is molded from rubber mainly composed of buthyl rubber and is formed into a hollow sphere, and a valve 1a is disposed in one end of the tube 1. The tube 1 is made so that it is inflatable to a sphere of 186 mm diameter, when a certain quantity of air is blown into the tube 1 through the valve opening 1b to an internal pressure such that the material itself of the tube 1 is not stretched.

A covering layer 2 is a very thin rubber pouch mainly composed of natural rubber latex, and shaped like a rubber balloon. The covering layer is made so that it inflatable to a sphere of 80 mm diameter, when a certain quantity of air is blown into the covering layer 2 to an internal pressure such that the material itself of the covering layer 2 is not stretched. The material which is employed as the covering layer 2 has the property indicated as follows, high expansivity, a low stress arising from a 100 % extension is 3 kg per square centimeter, light weight, and 0.5 mm thickness to prevent its breaking in use.

The material which is used for the very thin rubber pouch has the

property, preferably, which indicated as follows, a low stress arising from a 100 % extension is under 5 kg per square centimeter, and 0.2 mm - 0.8 mm thickness to prevent its breaking in use. However, there is no limit to the material so long as the material may be made of a material which does not permit the solution of an adhesive agent such as an aqueous solution of latex or a solution of an adhesive agent which contains rubber to diffuse through the pouch.

Then, a surface of the tube 1 is smeared with the powder of inorganic lubricant 3 when the tube 1 is not inflated. This tube 1 is inserted into the covering layer 2, and a neck portion of the covering layer 2 is cut out to expose the valve 1a of the tube 1 from a surface of the covering layer 2. Subsequently, air is filled in the tube 1 through the valve opening 1b, and the tube 1 is inflated till the covering layer 2 is sufficiently inflated.

In this case, because of the existence of the inorganic lubricant 3 between the tube 1 and the covering layer 2, an adhesion between the tube 1 and the covering layer 2 is prevented, and a sliding motion is caused between the tube 1 and the covering layer 2. Therefore, both the tube 1 and the covering layer 2 may inflate uniformly without any sticking.

Furthermore, the material having high expansivity, and low stress arising from extension, is employed as the material of the covering layer 2. Therefore, a pressure from the covering layer 2 to the tube 1 is low, when the covering layer 2 is sufficiently inflated. The tube 1 is thus protected by the covering layer 2.

Subsequently, a trapezoid shaped cotton cloth piece 4 is impregnated with an aqueous solution of latex which contains a vulcanizing agent, and the cloth piece 4 is attached on the surface of the covering layer 2. Natural or artificial latex also may be used as this latex, though the natural latex is superior in adhesion and elasticity. This latex solution is infiltrated into the inter-

fiber spaces of the cloth piece 4, and produces caking on the cloth piece 4 as a reinforced layer 5 after drying and vulcanization as described later.

These cloth pieces 4 have a strip like shape and have a little bigger size than a strip formed by equatorial division of the covering layer 2 along the circumference of the covering layer 2 into eighteen parts, and are attached closely on the surface of the covering layer 2, by overlapping these adjacent edge to each other.

Thus, the rubber material which composes the rubber pouch of the covering layer 2 which does not permit an aqueous solution of latex to diffuse through the covering layer 2. So the solution of the adhesive agent does not enter into the space between the tube 1 and the covering layer 2, and the adhesion between the tube 1 and the covering layer 2 is prevented.

Furthermore, the tube 1 which is covered by the covering layer 2 and the reinforced layer 5 is set into a flask for line drawing, and a line is drawn at the center of an overlapping portion of the adjacent cloth piece 4 of the reinforced layer 5, respectively. And a rubber piece 7 shaped like tape is adhered on the line. Subsequently, the tube 1 is set into a flask which has spherical shape inside, and the reinforced layer 5 is contacted to an inner surface of the flask by filling air into the tube 1, and the rubber piece 7 is hot vulcanization treated. A shallow groove is formed at a portion on an inner surface of the flask corresponding to where the rubber piece 7 is contacted respectively. And after vulcanization, low rubber protruding bars are formed on the surface of the reinforced layer 5. These bars are used as alignment guides 8 which for bonding of outer layer 6 in the next step.

Because of the existence of the inorganic lubricant between the tube 1 and the covering layer 2, the adhesion of the tube 1 and the covering layer 2 which is caused by hot vulcanization is prevented, therefore, the space between the tube 1 and the covering layer 2 is

maintained.

Lastly, eighteen pieces of strip shaped outer layer 6 are adhered on the reinforced layer 5 respectively, along the alignment guides 8. This ball is heated to 60 - 70°C and pressed from outside, to finish forming the ball. It is a matter of course to open a hole to one of the eighteen outer layers 6 for air supply through the valve opening 1b.

The boundary portions of the outer layer 6 are strong, because the alignment guides 8 are laminated on the overlap of cloth pieces 4. Thus, there is no anxiety about bursting at these boundary portions of the outer layer 6 in use.

By forming the covering layer 2, reinforced layer 5, and outer layer 6, as described above, the strength of the ball is advanced. Further, because of the existence of the inorganic lubricant between the tube 1 and the covering layer 2, a sliding motion take place between the tube 1 and the covering layer 2, and even if the ball receives a shock from outside, this shock is reduced by this sliding motion and the compression of the air in the tube 1 is prevented, thus, reducing the strain against the ball and improving the durability of the ball.

Furthermore, because of the existence of the space between the tube 1 and the covering layer 2, thin air layer is formed between them. So, the elasticity of this air layer in addition to that of the air filled in the tube 1 allows high softness, and desirable elasticity of the ball.

In the above described first embodiment, the surface of the tube 1 is smeared with the inorganic lubricant and the tube 1 is inserted into the covering layer 2, meanwhile, the inorganic lubricant may be injected into the covering layer 2, or the suspension of inorganic lubricant such as zinc solution of stearic acid may be spread on the surface of tube 1. And a neck portion of the covering layer 2 also

may be previously cut out before the insertion of the tube 1.

Also in this embodiment, the covering layer 2 consists of the very thin rubber pouch which is made of the material which does not permit as an aqueous solution of latex to diffuse through the pouch. And the cloth piece 4 is attached it with an aqueous solution of latex, though the adhesive agent is not limited in latex. Then, the covering layer 2 may consists of the very thin rubber pouch which is made of the material which does not permit the solution of an adhesive agent which contains rubber to diffuse through the covering layer 2, and the cloth piece 4 may be bonded to it with the solution of such adhesive agent, to prevent the adhesion of the tube 1 and the covering layer 2 and to form the space between the tube 1 and the covering layer 2.

Next, we illustrate a second embodiment of the present invention. A tube 1 previously smeared with the powder of mica is inserted into a covering layer which is made of the material which does not permit a solution of an adhesive agent which contains rubber to diffuse through the covering layer, according as the same procedure as in the first embodiment. Subsequently, air is filled in the tube 1 to put pressure upon inside of the covering layer, and the tube and covering layer are inflated to a spherical shape.

The material employed as the covering layer of this embodiment has property indicated as follows, high expansivity, a stress arising from a 100 % extension is 3 kg per square centimeter, and 0.3 mm thickness. This covering layer is formed to take an oval shape with 130 mm of its major axis and 120 mm minor axis when filling a certain quantity of air, such that the covering layer itself is not stretched.

The covering layer becomes a spherical shape by the pressurization of the tube which takes the shape in accordance with the quantity of air filling the tube, and the inflation along the circumference of the tube.

The very thin rubber pouch which forms covering layer of this embodiment has slack portions 9 which run parallel with vertical direction on its circumference, and because of the existence of the slack portions 9, air reservoirs are formed between the tube and the covering layer while the tube is inflated. Therefore, the existence of these air reservoirs and the inorganic lubricant causes a sliding motion between the tube and the covering layer more easily, and both the tube and the covering layer may inflate without any strain.

Subsequently, the reinforced layer is formed on the covering layer as a wound layer, by winding with yarns of resolcinol folmalin treated nylon 6,6 uniformly, using a friction type winding machine (refer to Japanese patent application, First publication, 56-13433) and apply an adhesive agent which contains rubber on yarns.

And then, the alignment guides are formed using the same steps as in the first embodiment, followed by adhering of the outer layer, and a finished sports ball is obtained.

The sports ball which is produced with the above steps, has strength provided by forming the covering layer, reinforced layer, and outer layer, as in the first embodiment. Further, because of the existence of the inorganic lubricant between the tube 1 and the covering layer 2, the sliding motion take a place between the tube 1 and the covering layer 2, and when the ball receives the shock from outside, this shock is reduced by this sliding motion and the direct compression against of the air in tube 1 is prevented. Then, the strain on the ball is relieved, therefore, the durability of the ball is improved.

And in the second embodiment, the covering layer 2 consists of the very thin rubber pouch which is made of the material which does not permit as a solution of the adhesive agent which contains rubber to diffuse through the pouch, and the reinforced layer is wound on the covering layer by winding yarns. Though, materials of these layer

are not limited in above described, the covering layer may consists of the very thin rubber pouch which is made of the material which does not permit as an aqueous solution of latex to diffuse through the pouch. And the reinforced layer also may be formed by winding yarns uniformly, and applying the adhesive agent which contains the solution of the adhesive agent on yarns.

Furthermore, shape, size, and construction of the tube, shape, size, composition, and construction of the covering layer, size, composition, and construction of the reinforced layer, composition of the adhesive agent, and the properties and composition of the inorganic lubricant are also not limited by the above embodiment.

The alignment guide is formed by forming of the reinforced layer, drawing lines, adhering the tape shaped rubber pieces along the lines, and hot vulcanizing of the rubber pieces in the flask. However, the method to form the alignment guide is not limited by the process, and the alignment guide may also be formed by covering the surface of the reinforced layer with rubber sheet, and hot vulcanizing of the rubber pieces in the flask.

As described above, the present invention comprises: the inflatable tube 1; the covering layer 2 which consists of the very thin rubber pouch which is made of the material which does not permit the solution of the adhesive agent to diffuse through the covering layer and covering the tube; the outer layer is formed by attaching of the cloth pieces 4 on the surface of the covering layer 2 or by adhering the wound layer, in which, the inorganic lubricant 3 is provided between the tube 1 and the covering layer 2, and the tube 1 is spaced to the covering layer 2. Therefore, the tube 1 is protected by the covering layer 2, the reinforced layer 5, and the outer layer 6, which are located exterior to the tube 1, so the strength of the ball is improved.

Especially, the tube 1 is covered with the covering layer 2 and the covering layer 2 is consists of the very thin rubber pouch which is

made of the material which does not permit the solution of the adhesive agent such as an aqueous solution of latex or the solution of the adhesive agent which contains rubber to diffuse through the covering layer 2, the adhesion between the tube 1 and the covering layer 2 is prevented, and the tube is spaced from the covering layer. Thus, the shock from outside is absorbed and relieved by the synergism of an air layer which is formed between the tube and the covering layer and the air which is filled in the tube. Therefore, a reaction which was forced on human body from the ball is reduced by about one third, and a touch of the ball feel more softly, and the properties of the ball is improved.

Further, because of the existence of the inorganic lubricant between the tube and the covering layer, a sliding motion is caused between the tube and the covering layer when the ball receives the shock from outside. Therefore, the shock is reduced by this sliding motion, and the durability of the ball is improved.

Furthermore, because of the spacing of the tube and the covering layer, a thin air layer is formed between the tube and the covering layer. Thus, an elasticity of this air layer in addition to that of the air filled in the tube allows high softness and desirable elasticity of the ball.

And in the production method of the present invention, powder of the inorganic lubricant is injected into the covering layer 2 which consists of the very thin rubber pouch which is made of the material which does not permit the solution of the adhesive agent such as an aqueous solution of latex or a solution of the adhesive agent which contains rubber to diffuse through the pouch, or powder or the suspension of the inorganic lubricant 3 is spread on the tube 1 and the tube 1 is inserted into the covering layer 2. Thus, the solution of the adhesive agent does not enter into the space between the tube 1 and the covering layer 2, so the tube 1 is spaced from the covering layer 2 and the ball which has the tube 1 which is slideable along the covering layer 2 may be obtained. Therefore, the

sports ball which has high performance may be produced with simple steps.

Accordingly, the sports ball may be produced by this production method with high efficiency compared to the prior production method, and this method may be used as the effective method for reducing the cost of mass production.

Furthermore, the ball produced by the method of the present invention is superior in its strength, may maintain its property by relief of the strain of the tube 1, so that the tube 1 and covering layer 4 is slideable through a space. And because of the elasticity which exists by the air layer which is formed between the tube 1 and covering layer 2, and the air layer which is filled in the tube, therefore, the two air layers are formed in the ball, capable of producing high softness, and desirable elasticity of the ball.

As illustrated in above description, the present invention provides a sports ball which is superior in properties such as strength, durability, softness, and elasticity to conventional sports ball, and the present invention produces such sports ball with simple steps and on a large scale.